03500.103094.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	:	Examiner: Anish P. Desai
HIROKATSU MIYATA, ET AL.	)	
	:	Group Art Unit: 1794
Application No.: 10/544,109	)	
	:	Confirmation No.: 9440
Filed: August 2, 2005	)	
	:	
For: MESOSTRUCTURED FILM, MESOPOROUS MATERIAL FILM, AND PRODUCTION METHODS FOR THE SAME	) :) :	

Commissioner for Patents
Washington, D.C. 20231

DECLARATION UNDER TITLE 37 C.F.R. §1.132

I, Hirokatsu Miyata, declare that:
(Name of Declarant)

1. I reside at 793-6 Minamiyana, Hadano-shi,
(Street Address, City, Country)
Japan.

2. I have been a Research Scientist at Canon Kabushiki Kaisha since 1987. Prior to my employment at Canon I held the positions of ______
(Year) (Title)

at ______ during the period ______. I have worked in the areas of
(Company) (Years)

______.

(Expertise)

3. I have received an undergraduate degree in Applied Chemistry
(Specialty)

from Waseda University in ______,
(Name)
a graduate degree from Waseda University in
(Name)

1987 and a doctoral degree in Engineering from Waseda
(Year) (Specialty) (Name)

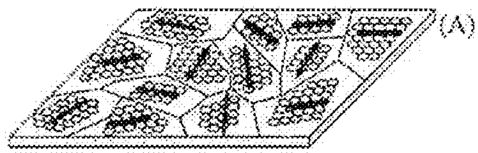
University in 2000.
(Year)

4. I have received 15 patents in my name in the field
Liquid crystal devices (Number)
of Mesoporous Materials and (list other honors, if applicable) ______

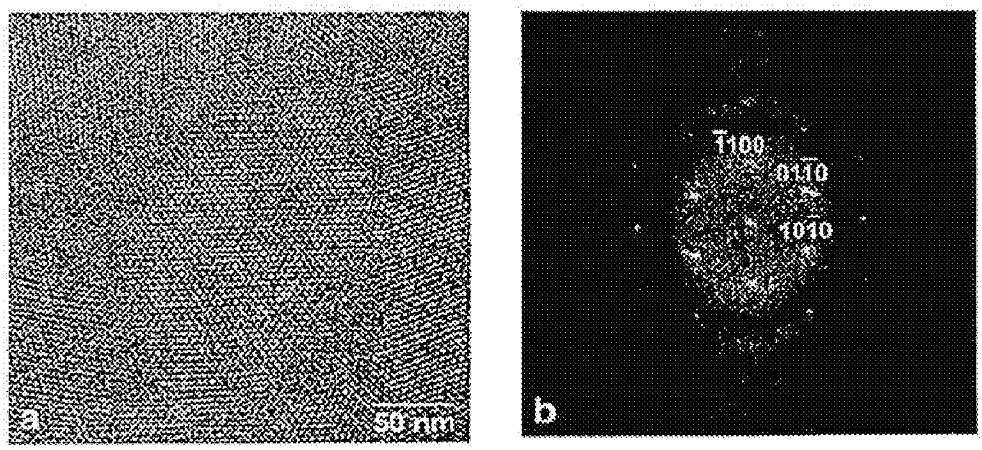
5. I am (an inventor of the subject patent application) or (experienced in the field of mesoporous silica thin films) and am familiar with the prosecution history of the subject patent application.

6. In the Advisory Action in the subject application mailed July 2, 2008 the Examiner, in the Continuation of Box 11, requested that the technical explanations presented in the reply filed June 19, 2008 be submitted in declaration form. Accordingly, I will respond to the Examiner's concerns by providing the technical analysis requested.

7. The mesoporous silica thin film in the cited Besson, et al. article can be schematically illustrated in the following drawing (A).

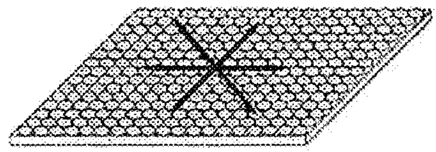


That is, while the film locally has a 6-fold symmetrical structure, the arrangement direction is not regulated across the entire film. The domains of the 6-fold symmetry have various degrees of freedom of rotation in the film and are randomly aligned. The above alignment of domains is indicated in "Figure 1" of the cited Besson article as reproduced below.



The above diffraction pattern "a" indicates the presence of local structures with 6-fold symmetry. However, the electron micrograph "b" of the diffraction pattern "a" clearly shows that domains different from the direction of the symmetric mirror planes of 6-fold symmetry are present in the film. In other words, the film in the Besson, et al., article exhibits a porous structure similar to that of a polycrystalline structure.

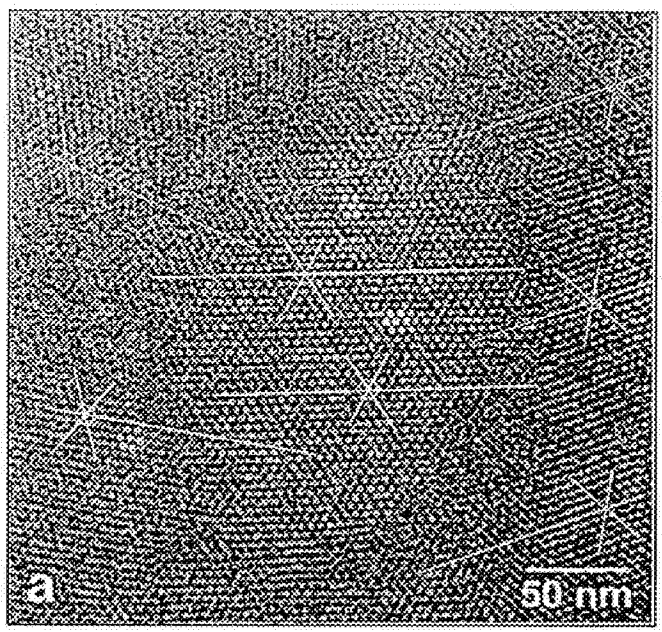
In contrast, the mesoporous silica thin film in the present claimed invention can be schematically illustrated as in the drawing below.



That is, unlike the structure of the mesoporous silica thin film in the cited Besson, et al. article, in the mesoporous silica thin film of the present invention, the symmetric mirror planes of 6-fold symmetry are present in the same direction throughout the film. In other words, the structure of the mesoporous silica thin film of the present invention is in a single-crystal state. Accordingly, Besson, et al. teaches away from symmetric mirror planes of 6-fold symmetry in the same direction throughout the film.

8. The Examiner has expressed concern how applicants arrived at the schematic drawing "A". Further, the Examiner argues Besson teaches a structured orientation of mesostructure. The Examiner is said to be unsure how Fig. 1b of Besson shows domains different from the symmetric mirror planes of 6-fold symmetry. The Examiner has requested a technical explanation as to how the symmetric reflective surface across the entire film is obtained. Each of these issues will be addressed.

9. Firstly, Besson describes a film structure on the basis of the results of plane TEM and section TEM. TEM is an analytical measure in which information on only an extremely minute area is provided. TEM analysis does not indicate the structure of the whole film. The following figure shows an enlarged view of Fig. 1a of Besson.



It can be clearly seen from the above figure that in this film, there are domains in which the in-plane arrangement directions of spherical fine pores are different, and in the boundaries thereof, the fine pore structures are unclear. The in-plane domains are identified by the crossed circles and the direction of orientation of the pores is shown by the lines through the crossed circles. The Besson film has a domain structure. (See the following portions in Besson article in which it is indicated that the film has a domain structure: page 12096, the left-hand column, lines 3-5 "... of the digitized HRTEM images of single domains in zone axis orientation (i.e., with one symmetry element parallel to the electron beam)."; and page 12096, the right-hand column, line 5 "... , as the film is strongly textured,".) That is, in many regions of the Besson film, when limited to very minute areas, there are 6-fold symmetric axes perpendicular to the film plane. However, since the various symmetric reflective surfaces face different directions depending on their positions in the film, the Besson film fails to satisfy the requirement such that symmetric

reflective surfaces face the same direction across the entire film. The direction of the domains is different over the in-plane region as shown by the non-parallel lines above.

10. The Besson film has various 6-fold symmetric axes perpendicular to the film. As the Examiner indicated, Fig. 1b of Besson shows certain 6-fold symmetry in the structure. However, it should be understood that the 6-fold symmetry can be found only in certain discrete areas of the in-plane arrangement in which the domains are not aligned in the same direction; which are defined by the diameter of an electron beam with which the diffraction pattern is determined.

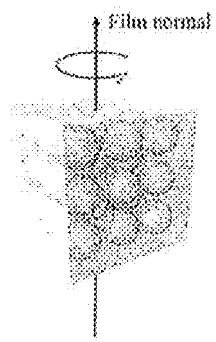
In Figure 1(b) of Besson, the symmetric reflective surfaces are denoted by straight lines. In the same domain, the symmetric reflective surfaces are parallel to each other. However, in different domains, it can be clearly seen that the symmetric reflective surfaces face different directions from each other.

11. In a film of the present invention, the local structure has been confirmed by TEM. In addition, detailed X-ray diffraction analysis has proved that the arrangement of the spherical fine pores in the in-plane direction is in one direction only. This in-plane X-ray diffraction analysis employs an incident angle as small as 0.2°, so that the entire surface of the film is analyzed. Using this technique, when the in-plane direction of the fine pores was determined, it was found to be only a single, uniform direction.

If x-ray diffraction analysis is not applied, it is not possible to determine the in-plane direction of the fine pores across the entire film. Where the film of Besson is using in-plane X-ray diffraction analysis, the in-plane structure is seen to be isotropic (i.e.,

in all directions). The reason is that the Besson film has a domain structure, and each domain has a degree of freedom of rotation around an axis perpendicular to the film plane. Based on the above, the inventors depicted the film structure as shown in drawing (A).

12. As the Examiner indicated, Besson discloses that laminating in the layer thickness direction is uniform. However, the Besson film is composed of domains with different in-plane directions of the fine pores. Although exhibiting different in-plane directions for the domains, the film can be formed of a uniform structure in only the film thickness direction. Each of the domains in the Besson film has a symmetry in which the structure as shown in the following figure is rotated around an axis perpendicular to the film plane.



Accordingly, even though the domains have different alignments in-plane, the film structure is uniform in the film thickness direction only across the entire film. This is consistent with the fact that the arrangement of the fine pores is not in the same direction in the film plane direction.

13. With respect to forming a film, the Examiner takes the position that since the conditions for forming the film of the present invention are similar to the conditions for forming the film of Besson, the present film should be similar to the Besson film. That assumption is not correct. In the present invention a substrate is typically prepared with an orientation derived via rubbing or by use of an L-B film of a polymer. Two film-forming methods, quite different from each other, can be used. One of the two is a gel-sol technique. The other is a hydrothermal crystallization method. These two methods use similar raw materials, but reaction conditions such as the chemical species, reaction rate, pH, temperature, and the like, are different.

The structure of the film formed by the hydrothermal crystallization method is thermodynamically determined, and the structure of the film formed by another production method, such as a spin coat method, based on sol-gel chemistry, is subjected to a kinetics factor. Although similar raw materials are employed, the different reaction conditions used cause different films to be formed. To show that different reaction techniques produce different films, a glass substrate without a polymer film formed thereon was subjected to a sol-gel deposition method to form a film. However, using the same materials, but employing a hydrothermal crystallization method, a continuous transparent film cannot be formed on the substrate.

Therefore, because different reaction parameters are selected in the present invention and because a different substrate surface is employed, the production method of the present invention yields different products from the process of Besson. Moreover, the structure of the claimed formed film is different from the structure of the Besson film as shown above.

14. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: July 18, 2008

Hirokatsu Miyata
(Declarant's Signature)

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